Nikon

OPTIPHOT
LABOPHOT BODY

REPAIR MANUAL

The repair guide for a beginner as well as an experienced technician

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Instruments group

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— CONTENTS —

CARE FOR STARTING REPAIR

- When carrying the microscope, hold its arm with one hand, and its base with the other.
- For replacement and others of the lamp bulb, do not touch it, after putting out the lamp, directly with the fingers.
- While the lamp is lighted, never bring any inflammable substances such as alcohol, gasoline, thinner, etc. near to the lamp housing.
- Take every caution in handling against shock.
- Be careful not to leave dust, finger marks, etc. on the lenses, lamp bulb, etc.
- Make sure of the power source voltage to be used (for example: LINE 100V, LAMP 6V, 20W), referring to the indication found on the transformer.
- Before replacing the fuse in the transformer, pull out the plug of the power source cord.
- For cleaning the lens surfaces, first remove dust, using a soft hair brush, or wipe it off lightly, using a gauze.
- Only for removing finger marks or grease, use a soft, clean cotton cloth, specified lens tissue or gauze, soaked with a bit of absolute alcohol (ethanol or methanol).
- For cleaning the parts painted or made of plastic, avoid the use of such organic solvents as alcohol, ether, thinner, etc.
- Do not use other tools other than the specified, except for an unavoidable case.
- Apply only specified oils to the parts, referring to the lubricant table, to keep up the efficiency of the instrument.

3. Lubricant and Adhesive

(Coaxial coarse-fine focus unit)

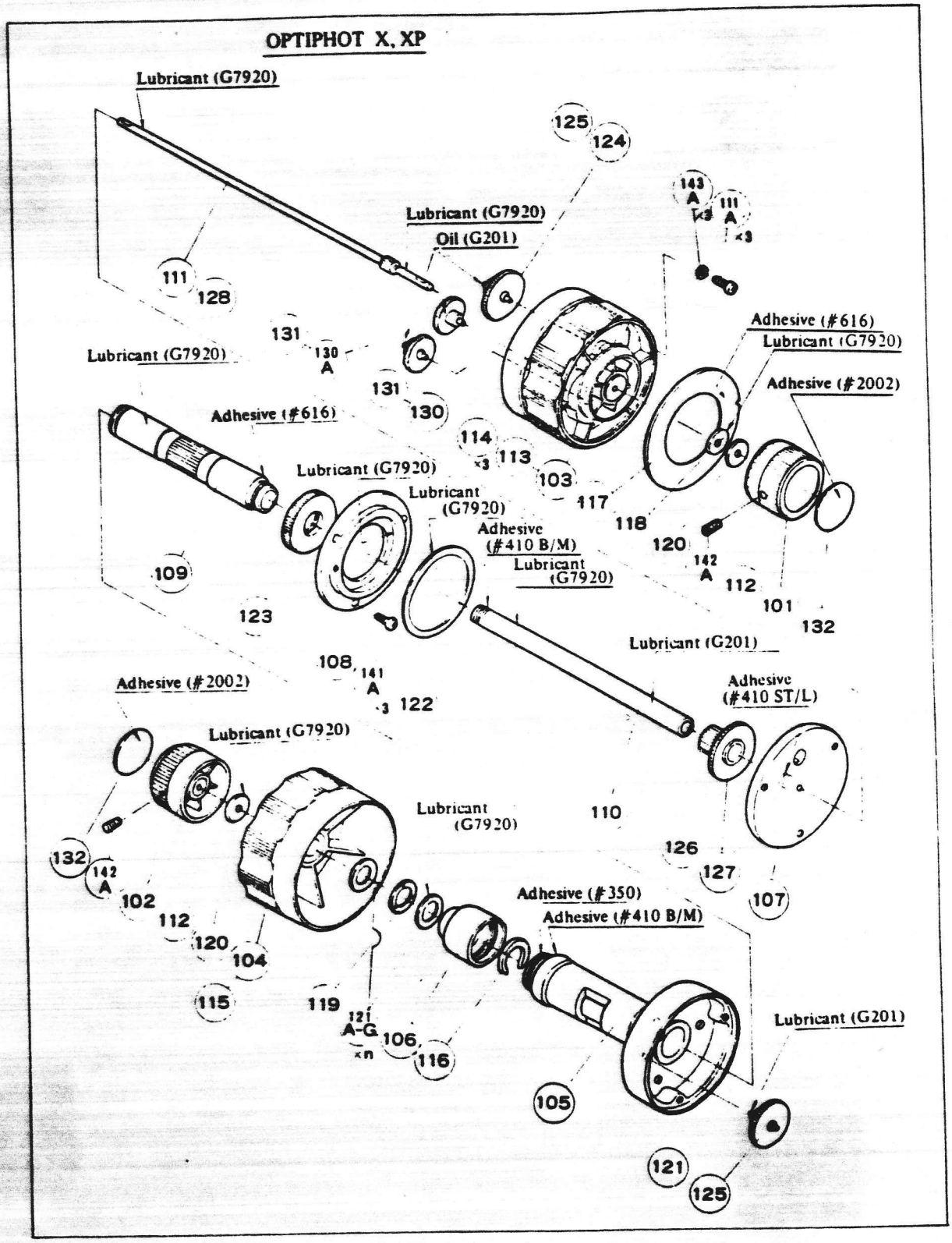

Fig. 9

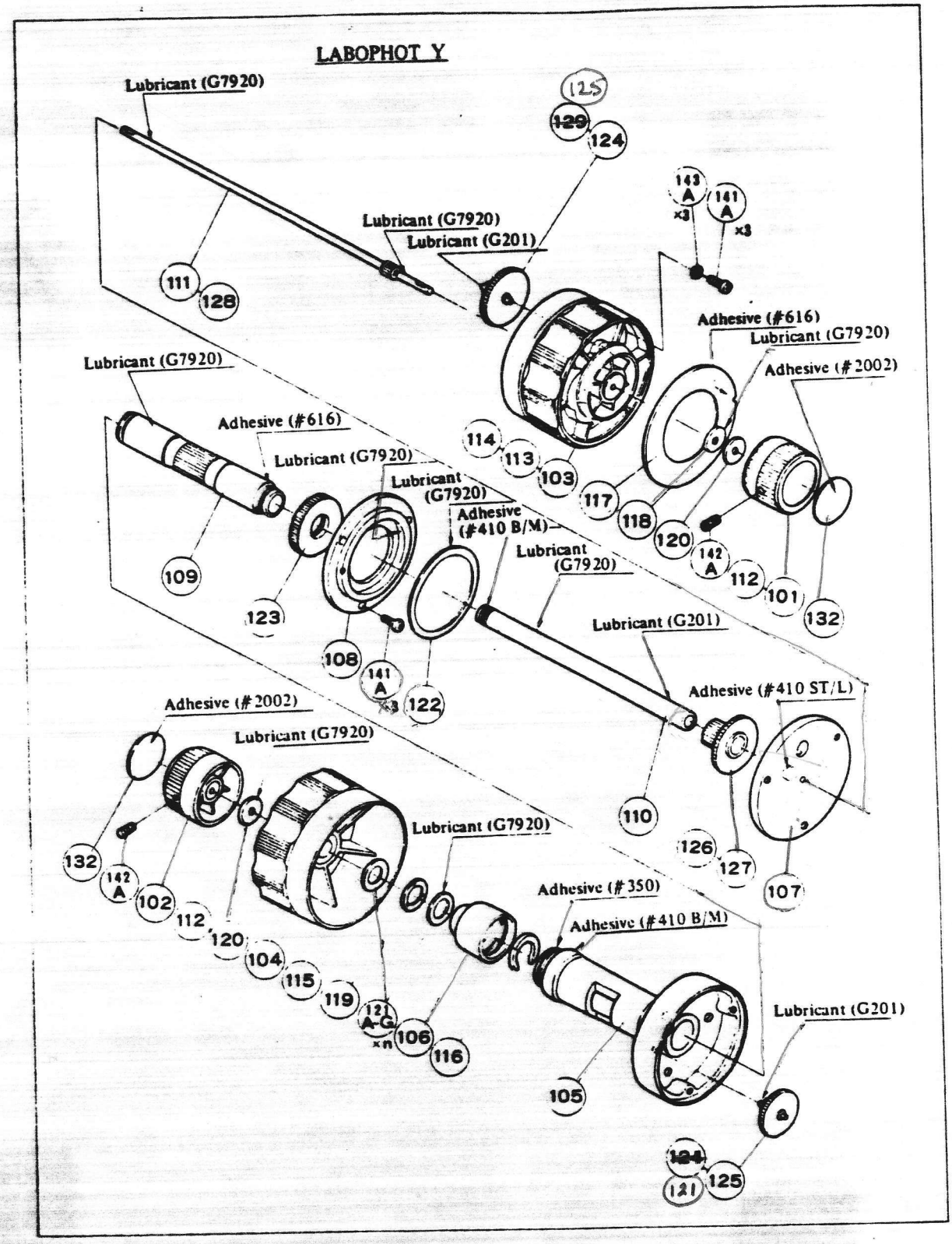
LABOPHOT Y
Lubricant (G7920)
125
129
124
143 A ×3
141 A ×3
Lubricant (G7920)
Lubricant (G201)
111
128
Adhesive (#616)
Lubricant (G7920)
Adhesive (#2002)
Lubricant (G7920)
Adhesive (#616)
114
113
103
117
118
120
142 A
112
101
132
109
Lubricant (G7920)
Lubricant (G7920)
Adhesive (#410 B/M)
Lubricant (G7920)
123
108
141 A ×3
122
Lubricant (G201)
Adhesive (#410 ST/L)
Adhesive (#2002)
Lubricant (G7920)
110
126
127
107
132
142 A
102
112
120
104
115
119
121 A-G ×n
106
116
Lubricant (G7920)
Adhesive (#350)
Adhesive (#410 B/M)
Lubricant (G201)
105
124
121
125

Fig. 10

(Substage Unit)

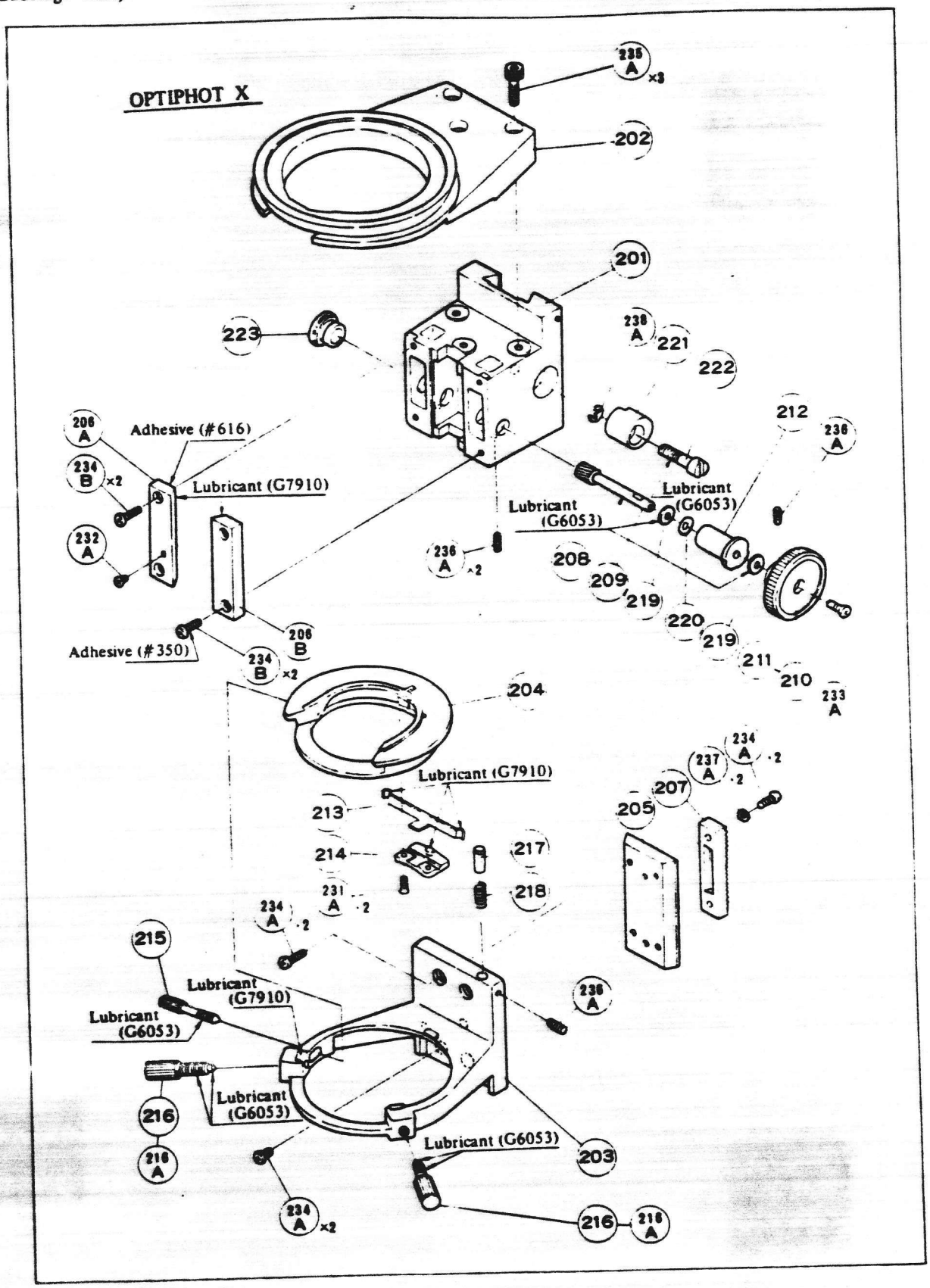

Fig. 11

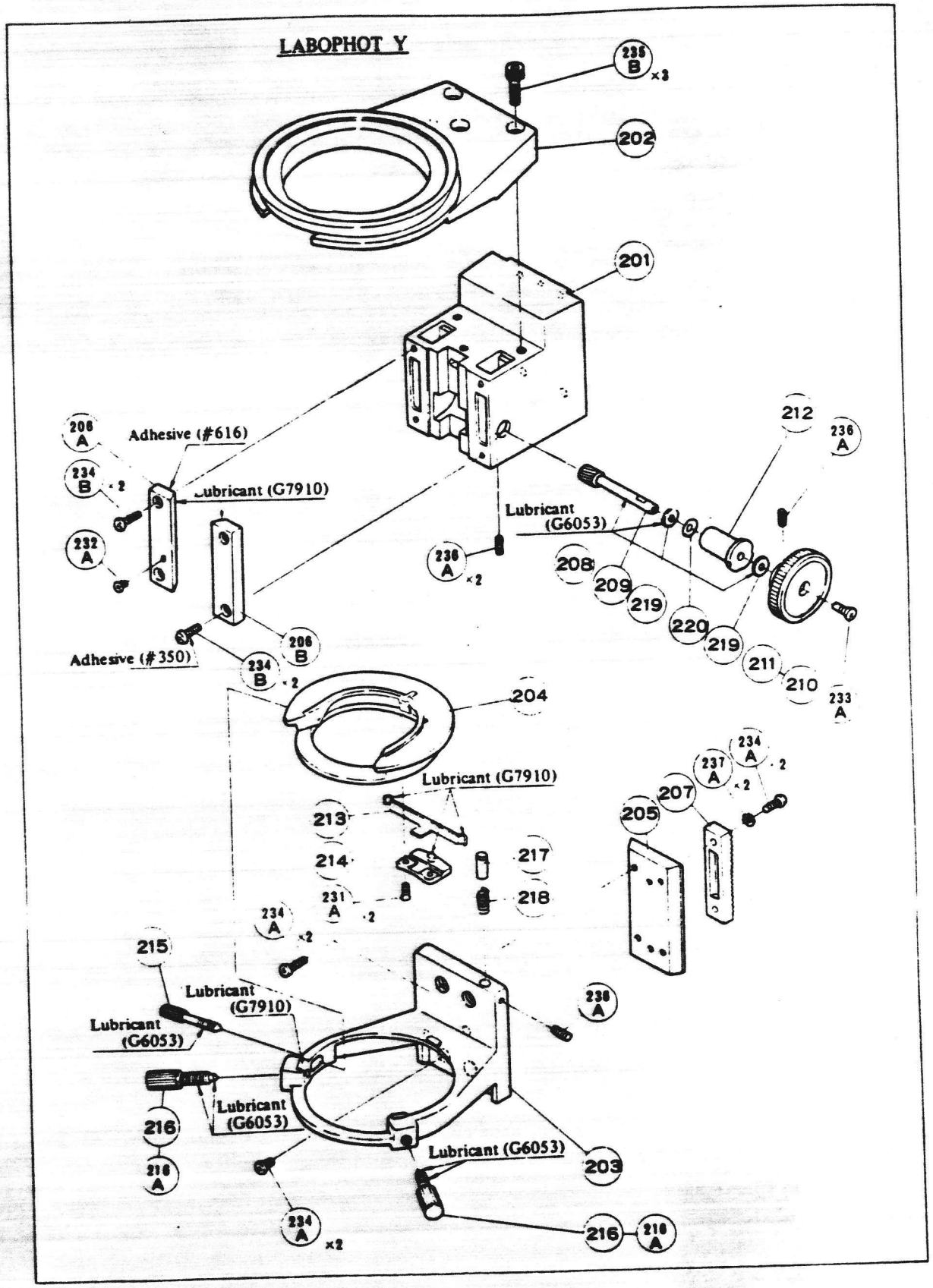
LABOPHOT Y
235 B ×3
202
201
208 A
Adhesive (#616)
234 B ·2
Lubricant (G7910)
232 A
212
236 A
Lubricant (G6053)
236 A ×2
208
209
219
220
219
211
210
233 A
Adhesive (#350)
206 B
234 B ·2
204
Lubricant (G7910)
213
214
217
218
231 A ·2
234 A ·2
237 A ·2
207
205
234 A ×2
215
Lubricant (G7910)
Lubricant (G6053)
236 A
Lubricant (G6053)
216
216 A
Lubricant (G6053)
203
234 A ×2
216
216 A

Fig. 12

(Arm Unit)

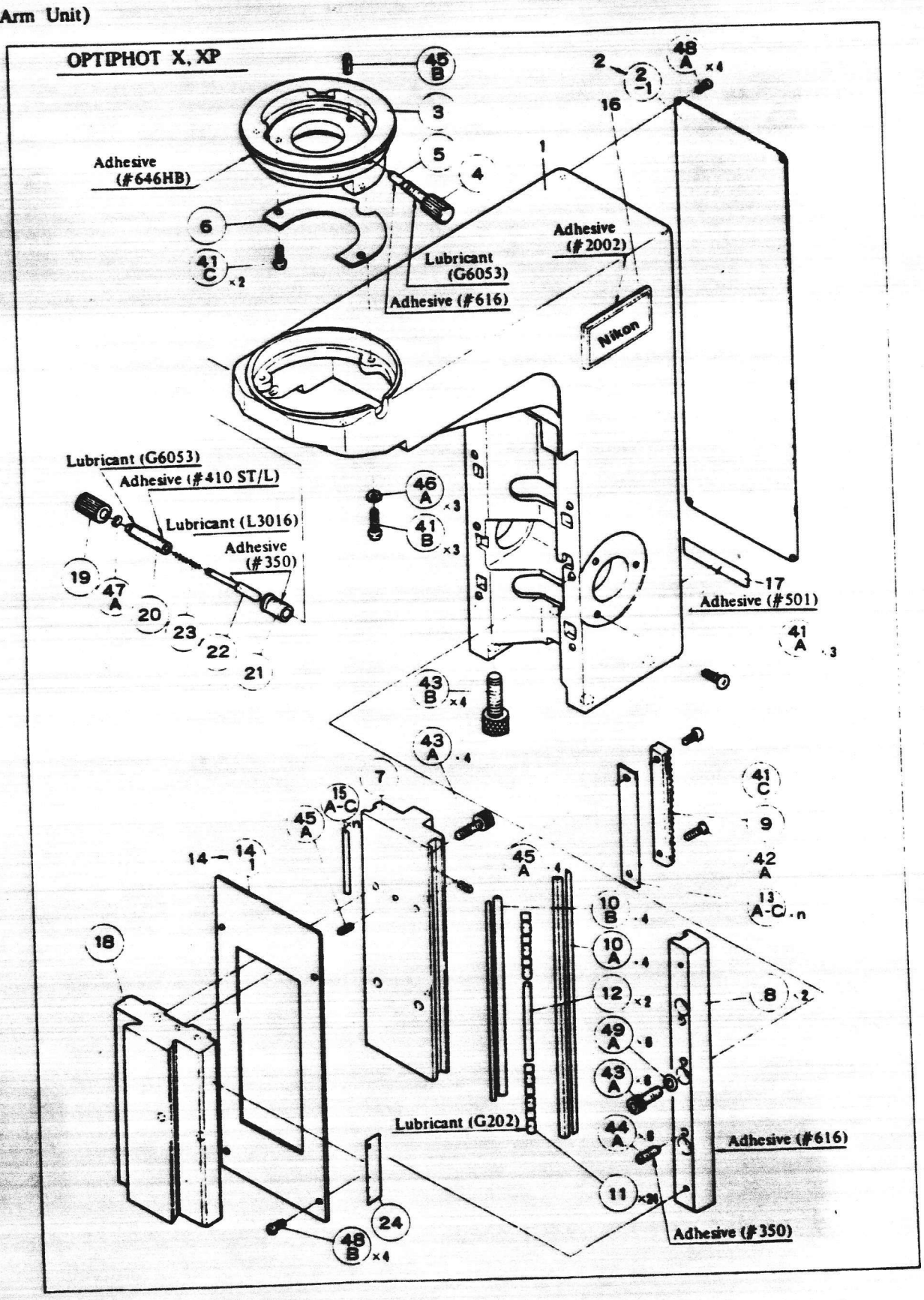

Fig. 13

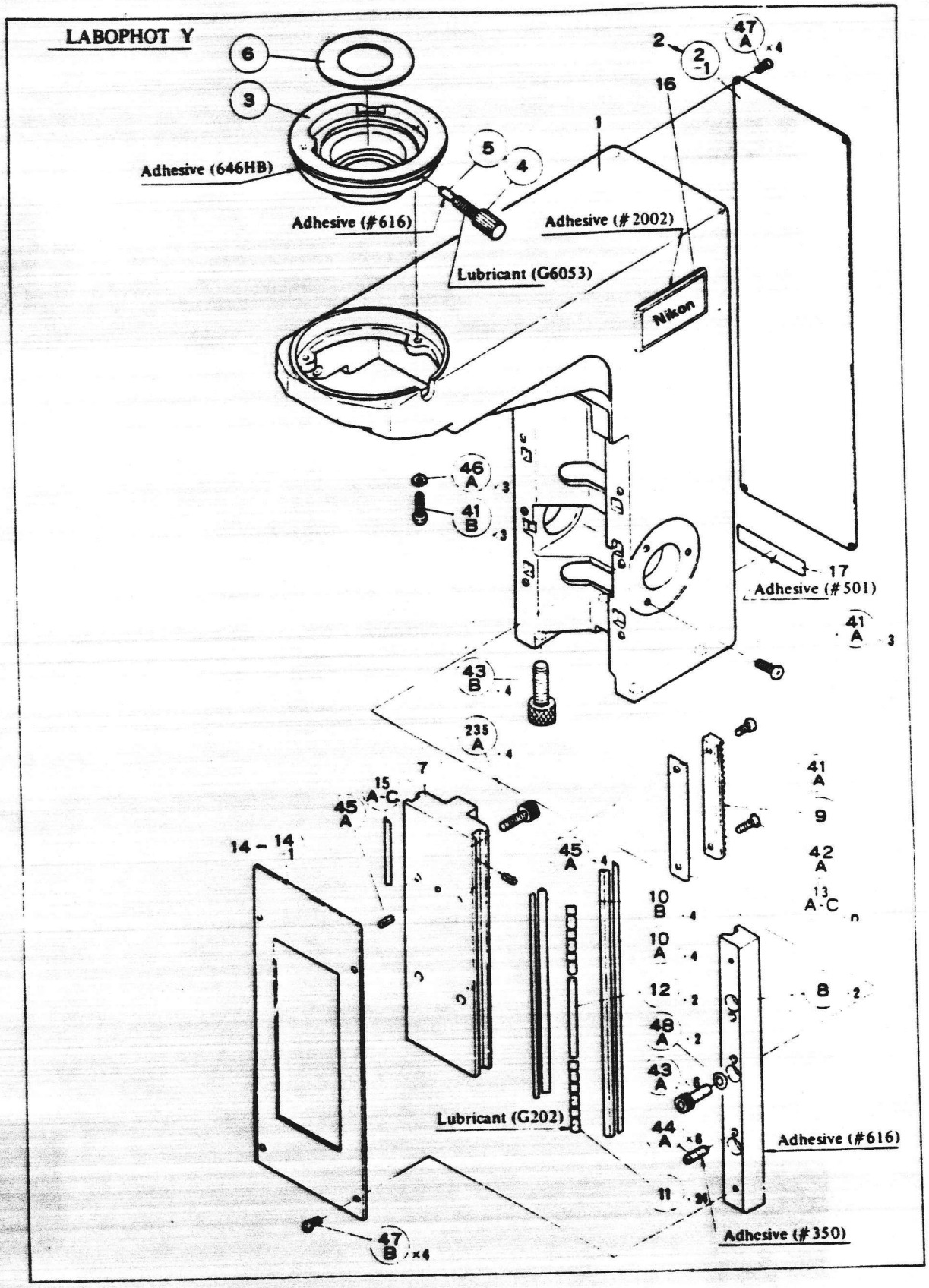
LABOPHOT Y
Adhesive (646HB)
Adhesive (#616)
Adhesive (#2002)
Lubricant (G6053)
Nikon
Adhesive (#501)
Lubricant (G202)
Adhesive (#616)
Adhesive (#350)

Fig. 14

(Nosepiece)

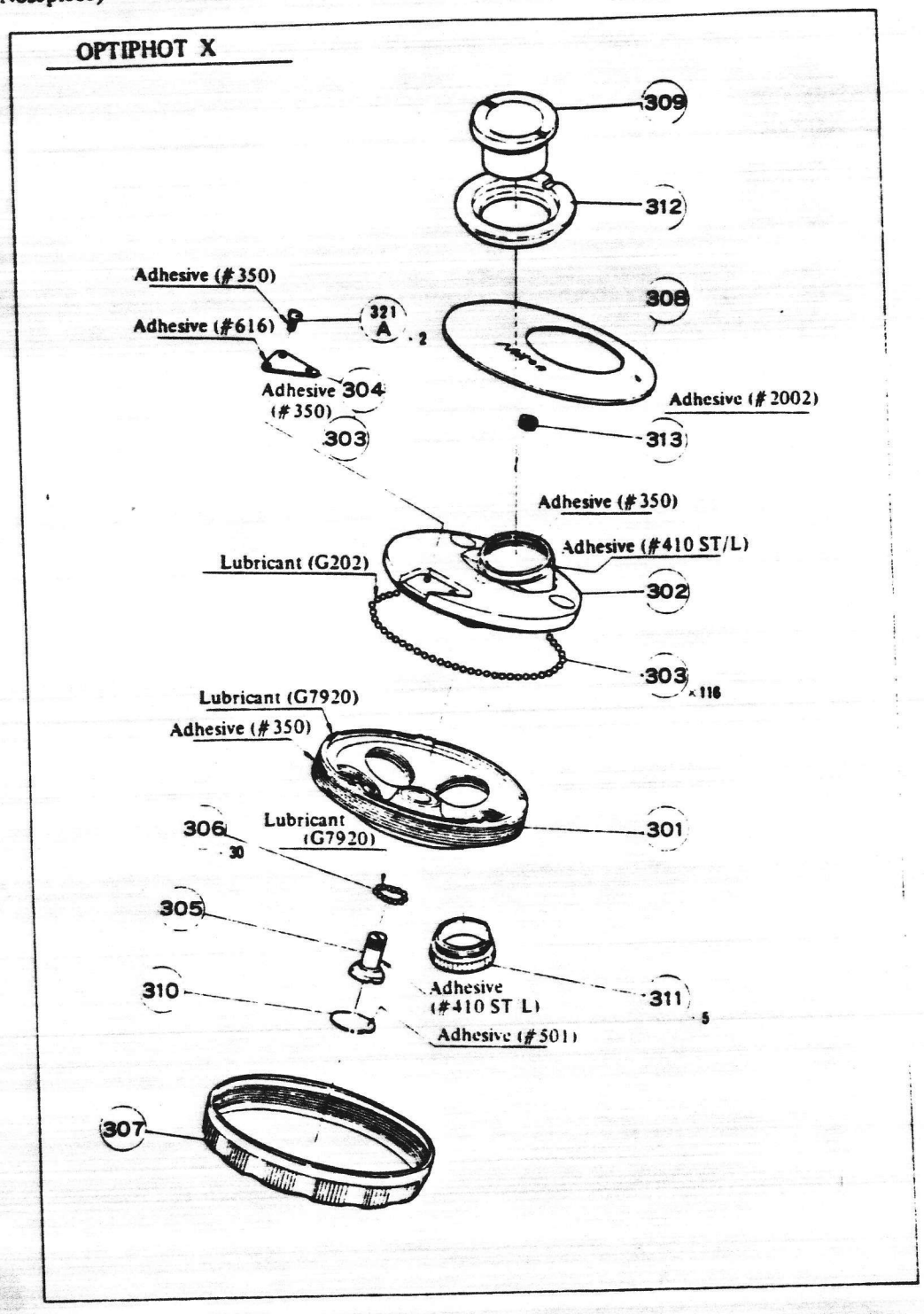

Fig. 15

(Base Unit)

Lubricant

(OPTIPHOT, LABOPHOT)

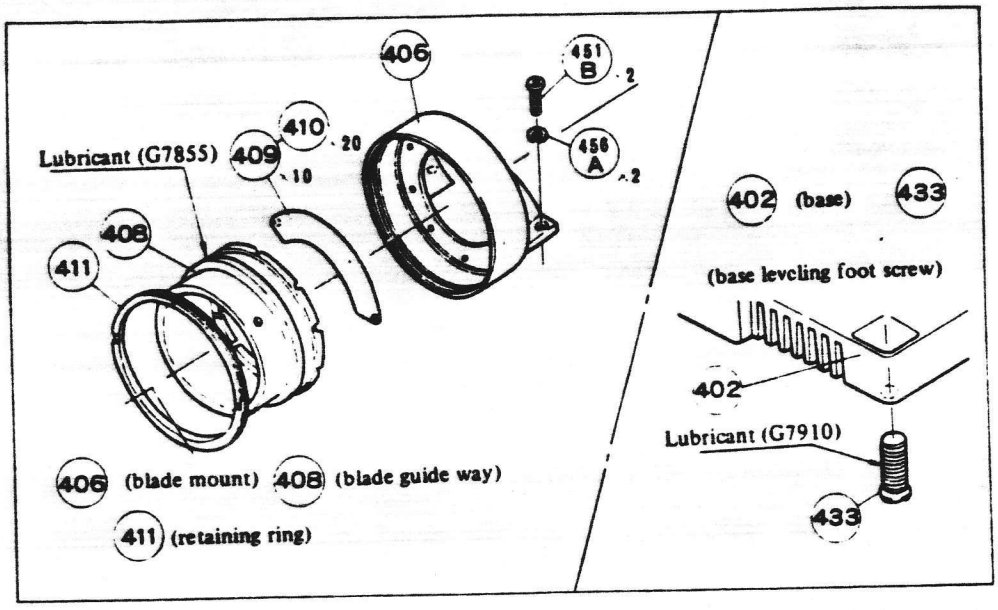

Fig. 17

Adhesive

(OPTIPHOT, LABOPHOT)

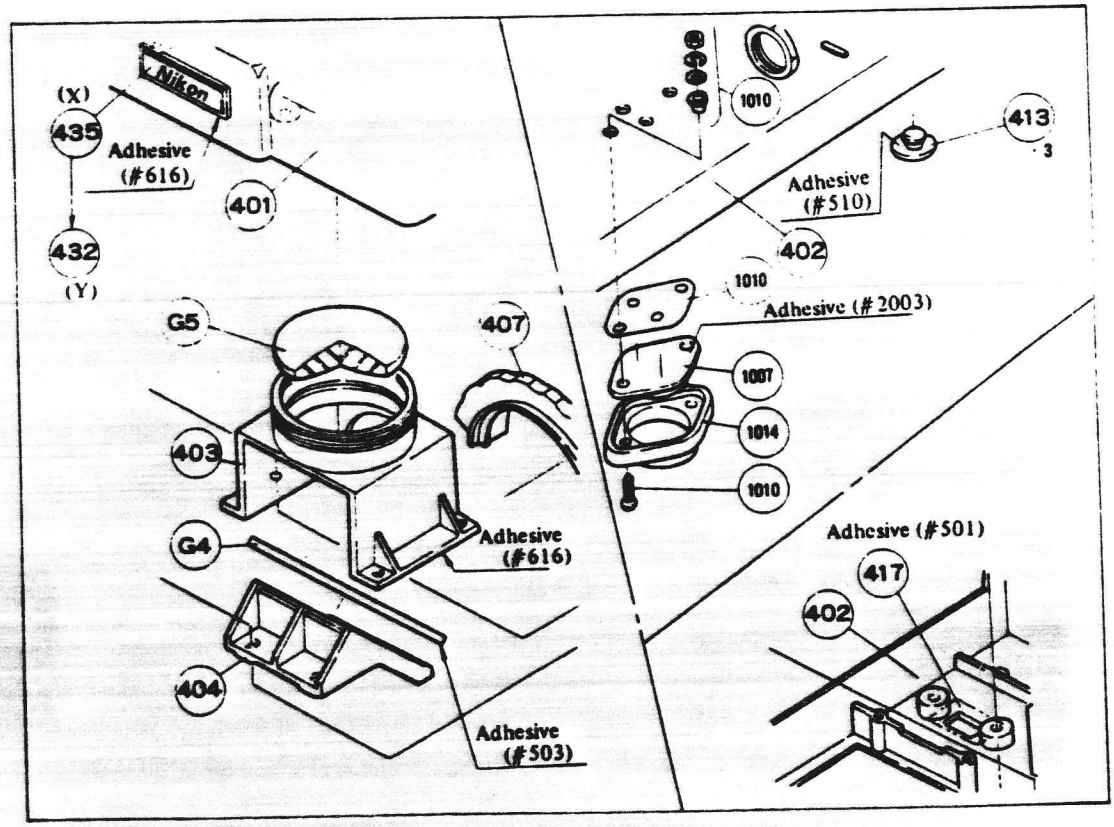

Fig. 18

MECHANISM AND PRINCIPLE

1. Coaxial Coarse and Fine Focus Unit

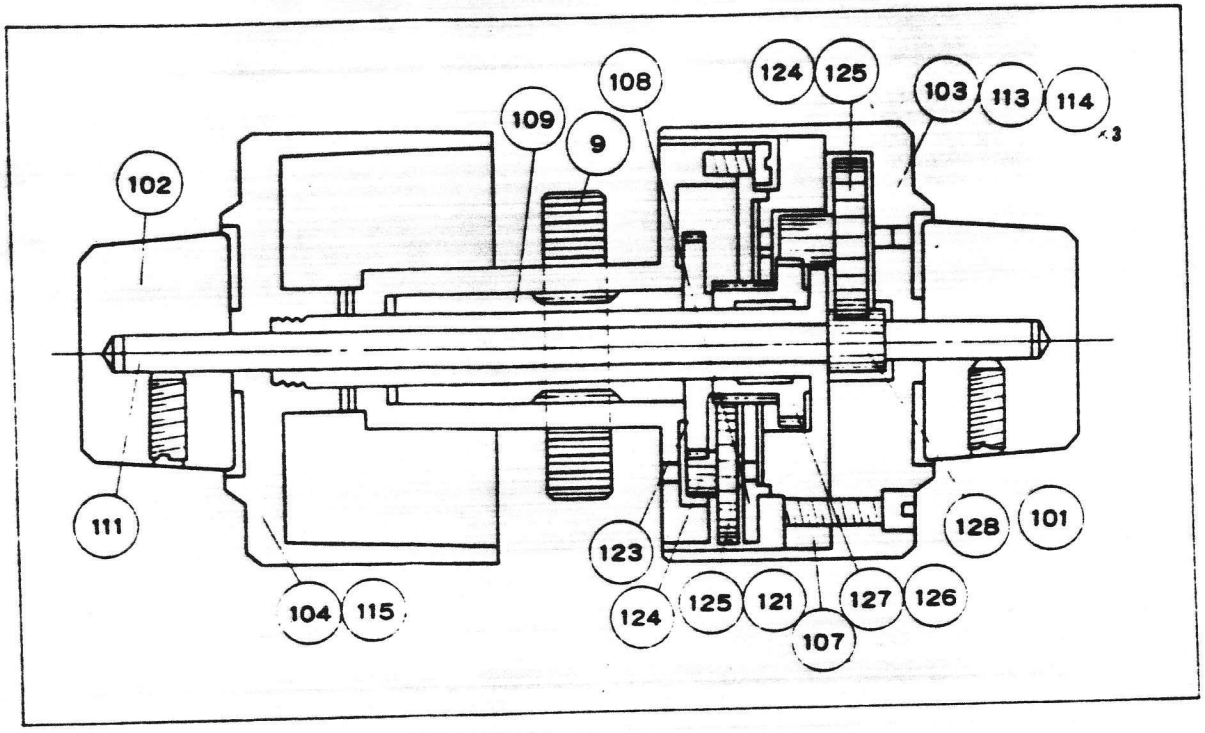

Fig. 24

1) Transmission of turning force of fine focus knob

- Turning force of the fine focus knob ((101) or (102)) is transmitted to the pinion shaft ((109)) to move the rack ((9)) vertically through the gear system ((128) , (130) , (130A) , (125) , (124) , (127) , (126) , (125) , (121) , (123)).
- In this transmission with such a reduction ratio as from (126) to (109) , the weight of the stage and substage, which exerts force to rotate (107) , is overcome by the friction offered by spring ((118)) to the sliding surfaces of (107) and (108) .
- Thus, even though some backlash is provided for each gear to enable smooth gearing, almost no slack will be seen in the rising and lowering directions of the stage, by virtue of the rotation force of the gears working in one direction under the weight of the stage.

2) Transmission of turning force of coarse focus knob

- No drop of the stage, which otherwise would occur while the coarse and fine focus knob is not operated, is due to the friction given by the spring (119) to the coarse focus knob, in the same way as in the case where the rotation force, produced under the weight of the stage and substage, even reduced through the whole system of gears, to turn the fine focus knob, is surmounted by the friction caused by the spring (118).

- In such a situation, when the coarse and fine focus knob (103 or 104) is turned, since no relative rotation between the coarse and fine focus knobs will take place, thus the gears (130), (130A), (125), (124) will not rotate on their axis in the coarse focus mechanism, but make the same rotation as the coarse focus knob, i.e. a revolution round the center of the pinion shaft.

- Therefore, when the coarse focus knob is turned, the gear (126) will make the same rotation as the coarse focus knob causing rotation to the pinion with the reduction ratio (126) to (125), (124) to (125).

Furthermore, in the staying position, even though the stage does not drop under its weight, the coarse focus knob will be moved by the turning of the fine focus knob.
This is on account of the fact that the change of the rotation force as well as the friction factor in the rotation position differ from those in the staying position owing to lubricant or the like.

DISASSEMBLY PROCEDURE

1. Coaxial Coarse and Fine Focus Unit (OPTIPHOT, LABOPHOT) (Fig. 10)

1) Releasing HS screw (142A), remove the right ((101)) and left ((102)) fine focus knobs.
In this case, take off plate spring (118) and washer (120), as well.

2) Rip off name plate (117) (cemented by No. 616) from the right coarse focus knob ((103)).
After releasing set screws (11A) ×3, take of (105) from gear case (107).

3) By removing (103) (together with bush (113) and bearing (114)), take off fine focus shaft (111), spour gears (128), (124) and (125), gear shaft (131), spur gear (130A) and gear shaft (131).
(LABOPHOT: Spur gears (111) and (128), (124) and (129)) (Fig. 25)

4) Turn the left coarse focus knob (104) and coarse focus gear case (107), counterclockwise, to remove (104) (combined with bush (115)) from coarse focus shaft (110).
In this case, (107) may separate from (110).

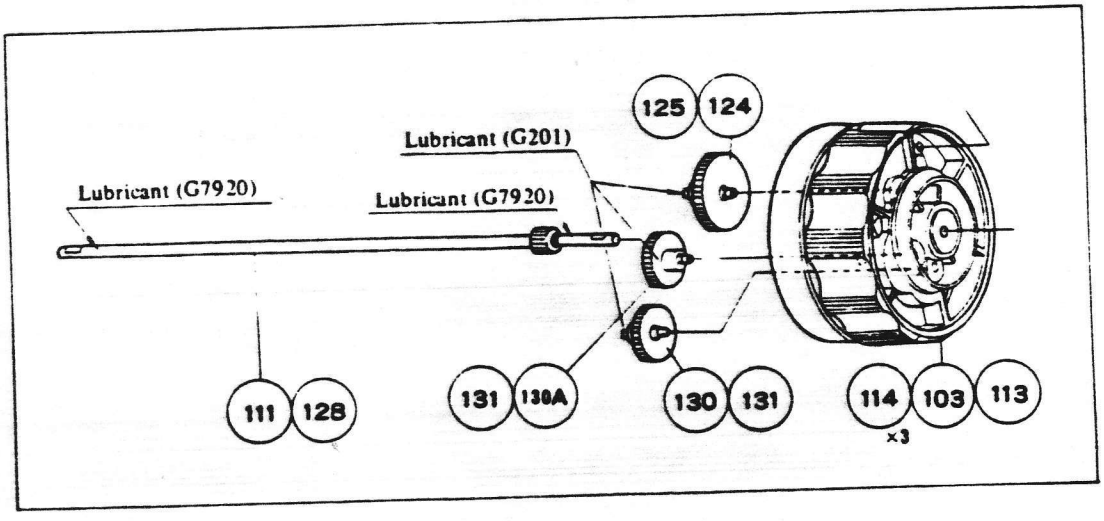

Fig. 25

5) Draw out coarse focus shaft (110). (Gears (126) and (127) will come in sight.)

6) Remove coarse focus bearing (108) as well as gears (121) and (125). (Fig. 26).

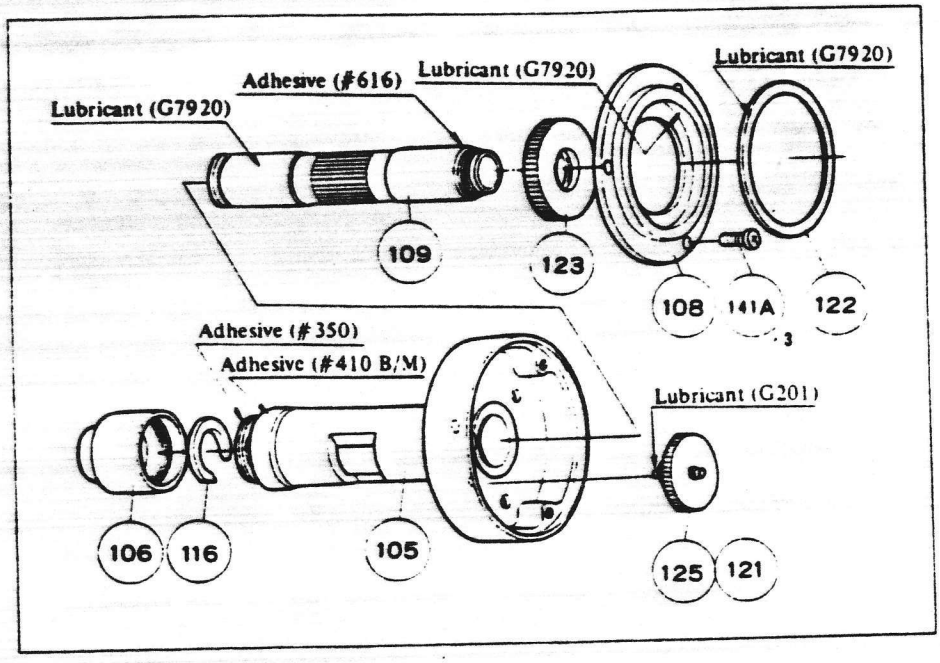

Fig. 26

7) Releasing HS bolts (43B) ×4, separate the arm unit from the base.

8) Releasing PM screw (41C) and CM screw (42), remove rack (9).

9) Immersing the subassembly consisting of (105), (109), (123), (116) and (106) into alcohol, separate coarse focus bearing (106).
Furthermore, take off thrust loose stopper (116), and then pinion (109) and spur gear (123) can be taken out.
((109) and (123) are cemented with each other by No. 616) (Fig. 26).

Note: Pinion case (105) can be left attached on the main body.

2. Substage Unit (OPTIPHOT, LABOPHOT) (Fig. 11, 12)

1) To remove the substage as a unit, release clamp screw (222).
(LABOPHOT: First, remove rear cover (2) and substage body (201) from roller race (male) (7)).

2) After releasing two set screws (236A) on the bottom of (201), remove pinion bearing (212). (Fig. 28).

3) Pinion (208) and pinion shaft (209) can be taken off, after condenser focus knob (210) (combined with bush (211)) has been removed. (Fig. 28).

4) After unscrewing PM screw (232A) on the (206A), remove the condenser carrier subassembly. (Fig. 28).
Condenser centering mount (303) and dovetail (205) having been attached in the correct position, using the tool, it is not recommended to detach them, so far as no problem arises. (Fig. 28).

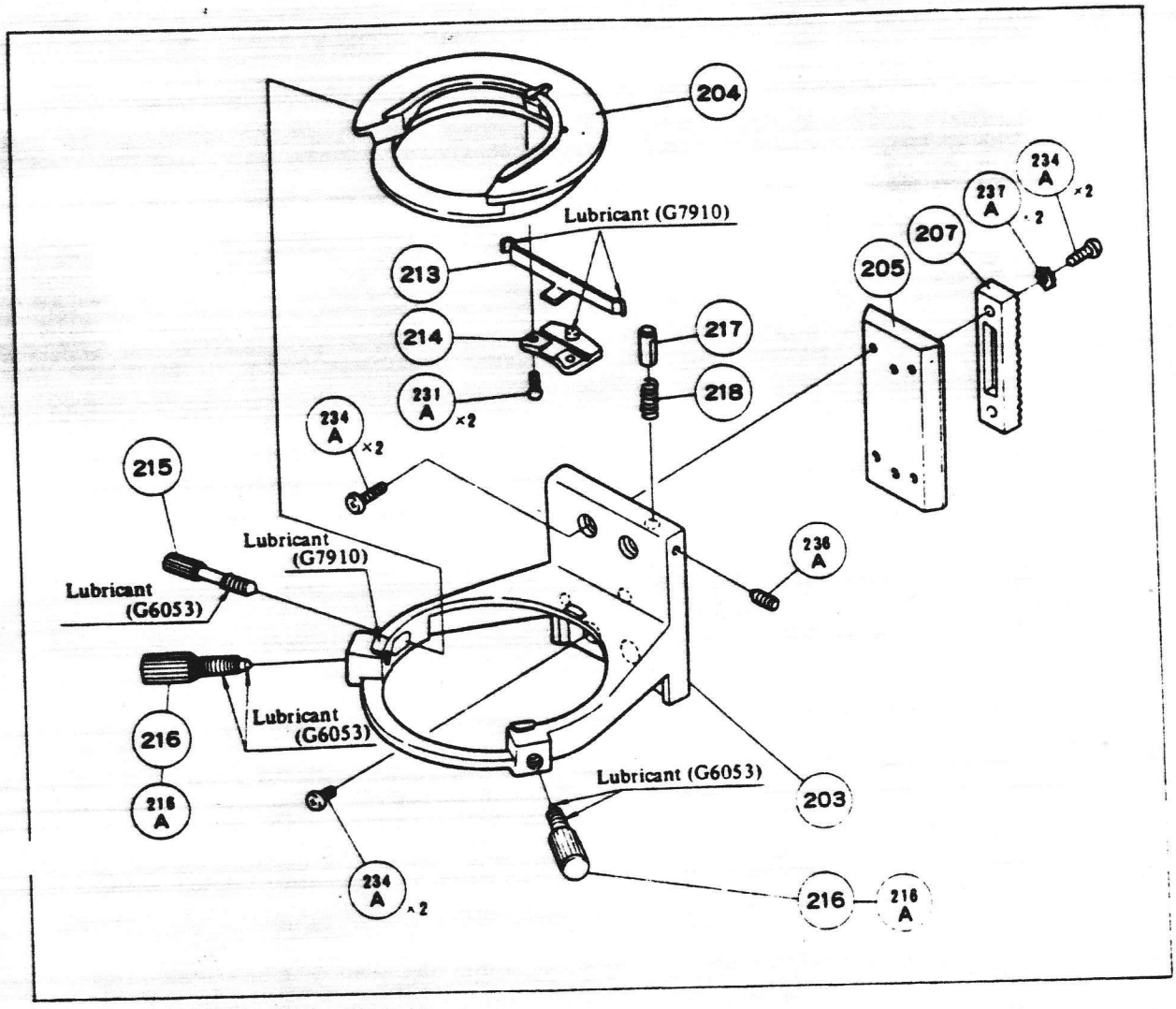

Fig. 27

5) Since of the two dovetail grooves (206A and 206B). 206A is to be used as fiducial in reassembly, remove only 206B in disassembly. (Fig. 28).

6) If stopper pin 217 has once been separated, because the top end is liable to be damaged, use the new one, which will facilitate reassembling with high accuracy. (Fig. 27).

7) The other parts can be dismounted in any sequence.

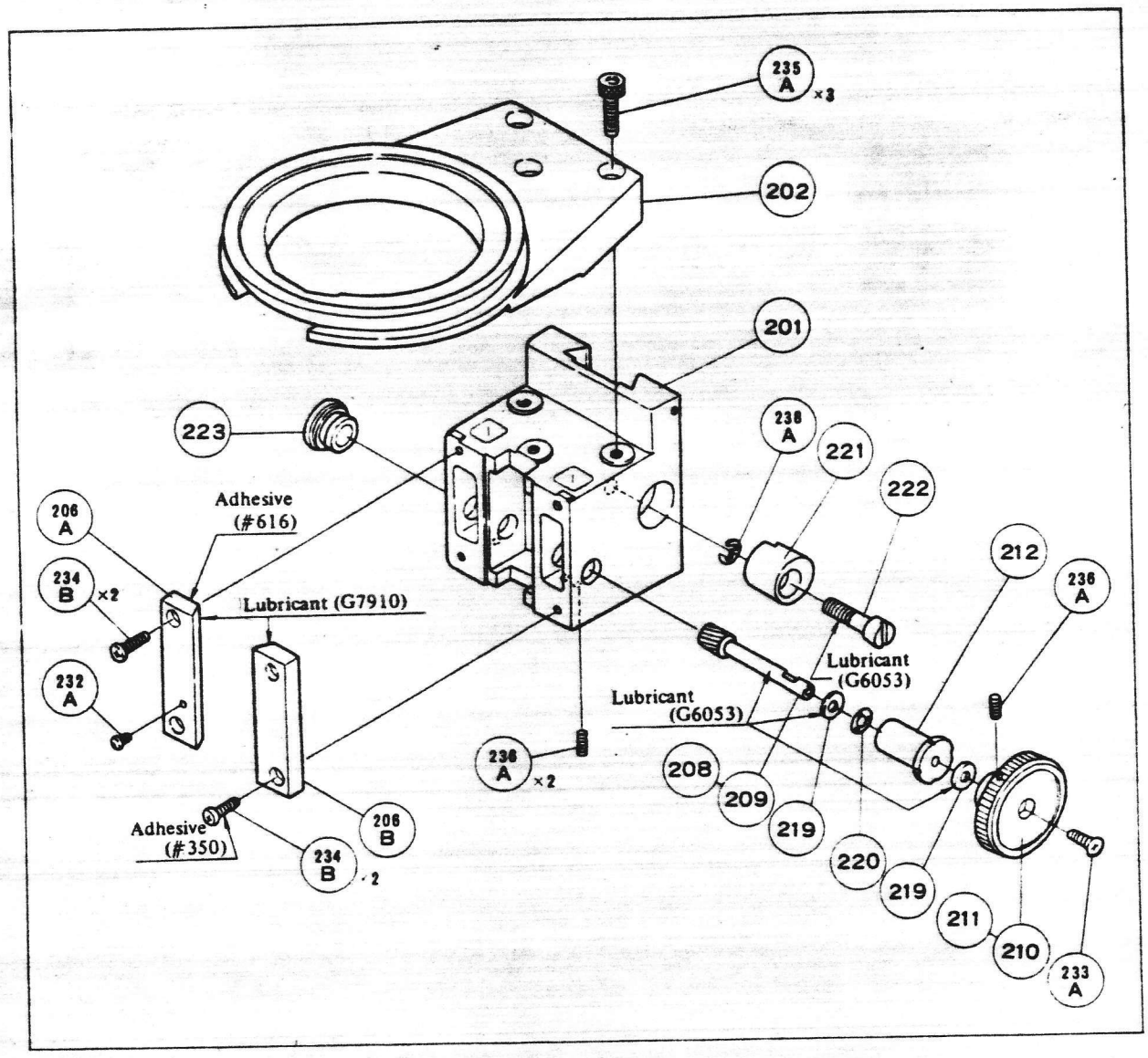
235 A ×3
202
201
223
238 A
221
222
206 A
Adhesive (#616)
234 B ×2
Lubricant (G7910)
212
236 A
232 A
Lubricant (G6053)
Lubricant (G6053)
238 A ×2
208
209
219
220
219
211
210
233 A
Adhesive (#350)
206 B
234 B ×2

Fig. 28

3. Arm Unit (OPTIPHOT, LABOPHOT)

1) Releasing HS set screws (48A) ×4 (LABOPHOT: (47A) ×4), take off rear cover (2).

2) Releasing HS set screws (43A) ×4, take off dovetail (18) (LABOPHOT: Screw (235A) and dovetail (201)) (Fig. 29).

3) Releasing HS screws (43B) ×4 (LABOPHOT: (47B) ×4), take off cover plate (14). (Fig. 29).

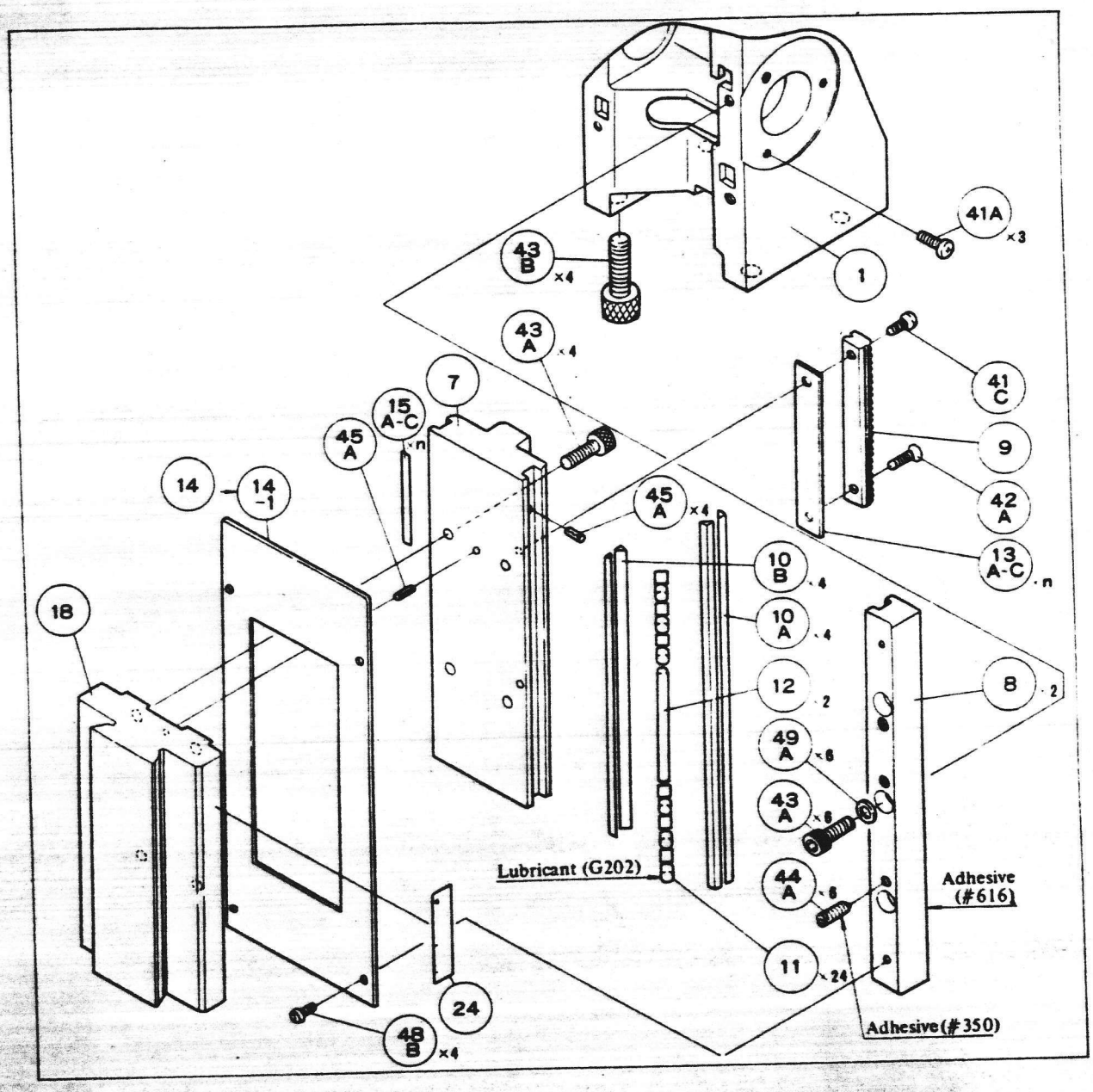

Fig. 29

4) After removing bottom plate (402) from the base, and releasing (43B) ×4, take off arm (1) from base body (401). (Fig. 29).

5) Releasing screws (41C) and (42A) (LABOPHOT: (41A) and (42A)), draw out rack (9) together with washers (13A) ~ (13C) toward the base. (Fig. 29).

6) Forcibly draw out roller race (male) toward the base. (Fig. 31).

7) Releasing screws (43A) ×3, remove roller race (female) (8).
(This (8) being cemented to main body (1) by (616), strike it with a wooden hammer).
In this case, the lefthand (viewed from the user) race being to serve as fiducial in reassembling, remove only the righthand one. At this time, cylindrical roller (11) and retainer (12) will separate.

< The disassembly described below should be attempted only by an expert >

8) Nosepiece subassembly (only for OPTIPHOT)
Follow the sequence as follows (Fig. 32 and 33):

i) Remove nosepiece clamp knob (19).

ii) Take off clamp screw receptacle (21) from main body (1).

iii) Remove E-ring (47A) to dismount clamp pin (22) and spring (23).

iv) Nosepiece clamp screw (20) and screw receptacle (21), though cemented by No. 410 St/L, can be unscrewed, using an ordinary tool.

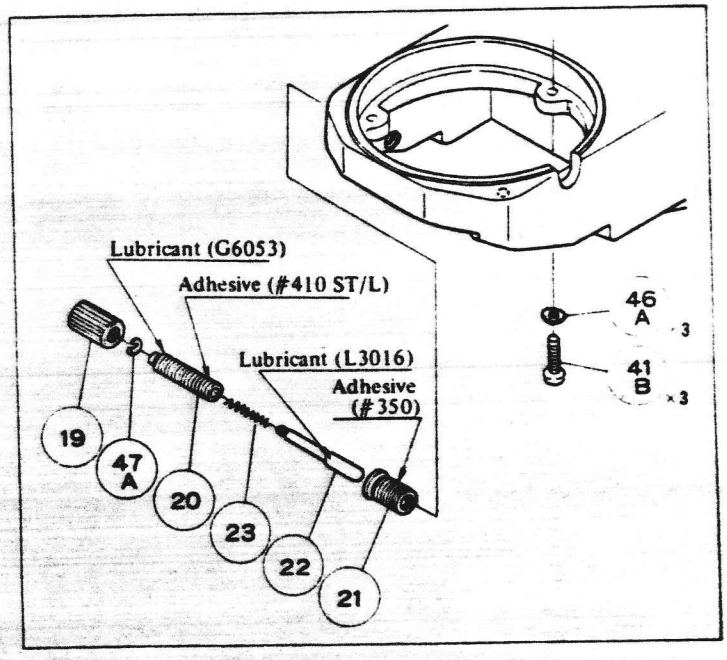

Fig. 30

9) Release screws (41B) ×3, and by striking tube receptacle (3) with a wooden hammer, take off the receptacle (3) from main body. (Fig. 31).

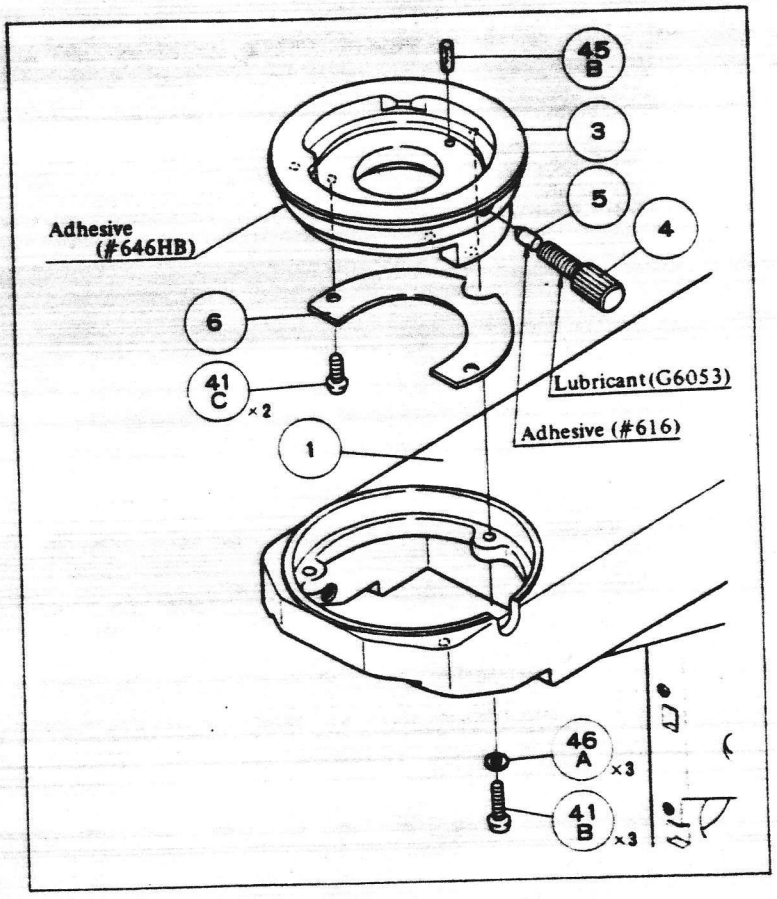

Fig. 31

4. Base Unit (OPTIPHOT, LABOPHOT)

1) Remove lens cap (405).

2) Releasing HS screws (452) ×4, remove base (401) and bottom plate (402). Beforehand, take off (G5) and (G6) (only (G5) for LABOPHOT).

<Field diaphragm (Fig. 36 and 37)>

3) Releasing PM screws (451B) ×2, remove blade mount (406) from bottom plate (402).

4) Remove field diaphragm controlling ring (407).

5) Remove retaining ring (411), and then blade guide way (408), blades (409) and dowel (410) will separate.

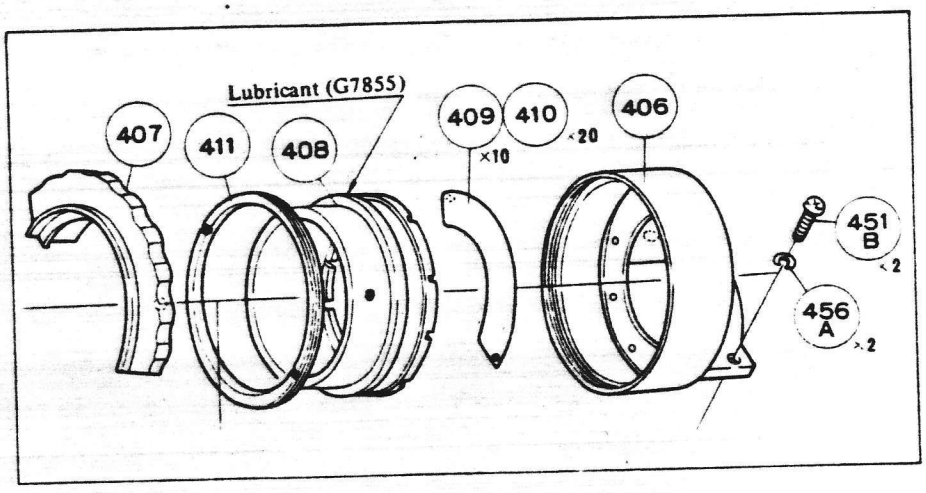

Fig. 32

6) Take out lens (422) (LABOPHOT: (418)) from filter receptacle (418) (LABOPHOT: From bottom plate (402)).

7) Remove retaining ring (424) (LABOPHOT: (427)), and then (G1) and (G2) (LABOPHOT: (G2) and (G3)), and spacer ring (423) (LABOPHOT: (429)) will separate.

R-6141-A

MBL 16100

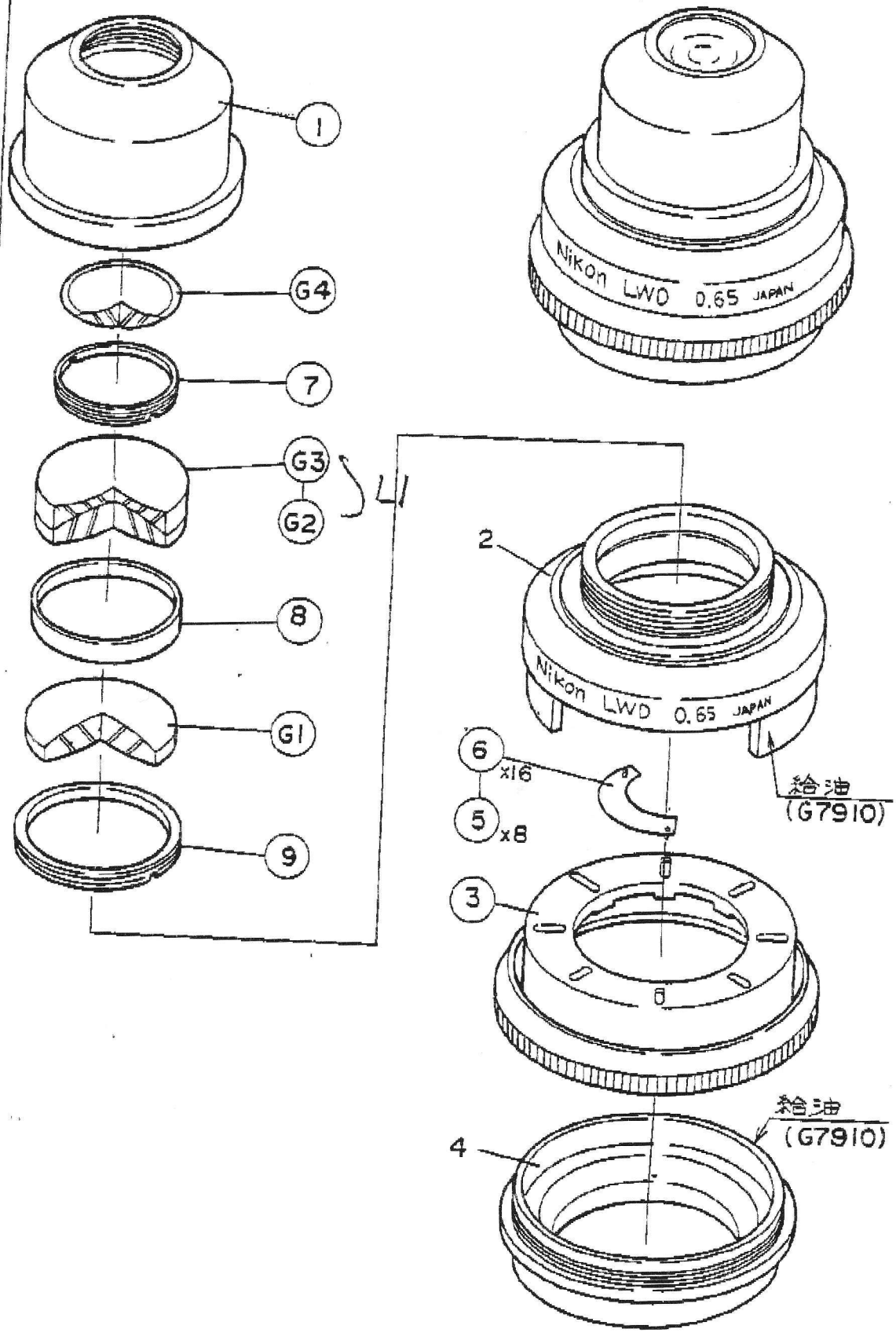

Fig. 1

PHK HATCHER

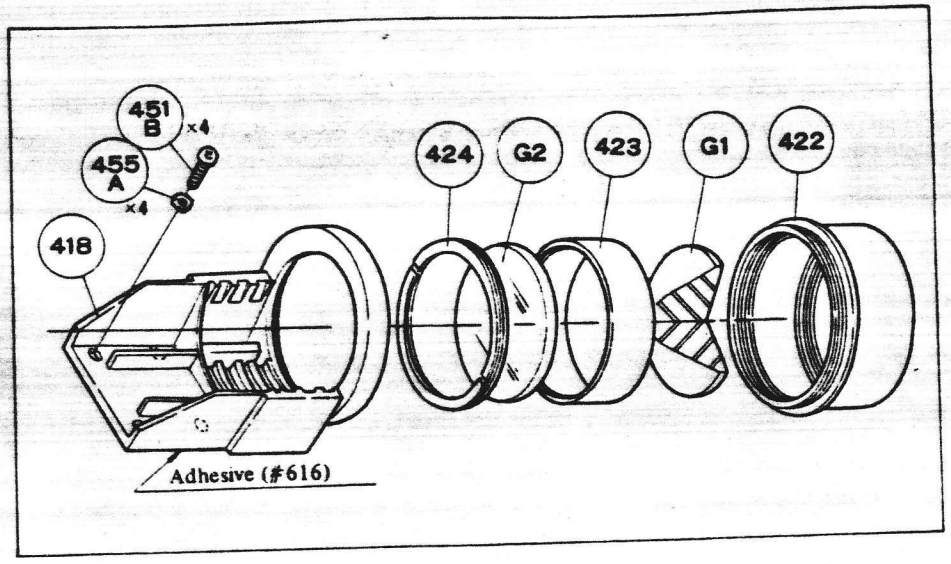

Fig. 33

< Removing variable resistor (1004) (LABOPHOT: (1003)) (Fig. 34) >

8) Take off brightness control dial (414) and bush (415).

9) By removing the nut, variable resistor (1004) (LABOPHOT: (1003)) can be separated.

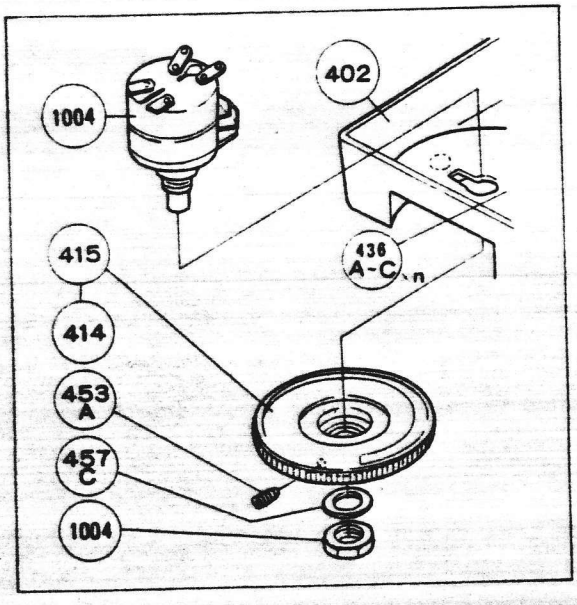

Fig. 34

< Removing mirror (G4) and mirror holder (404) >

10) After removing brightness indicator holder (only for OPTIPHOT), take off retaining ring (404). (Fig. 35).

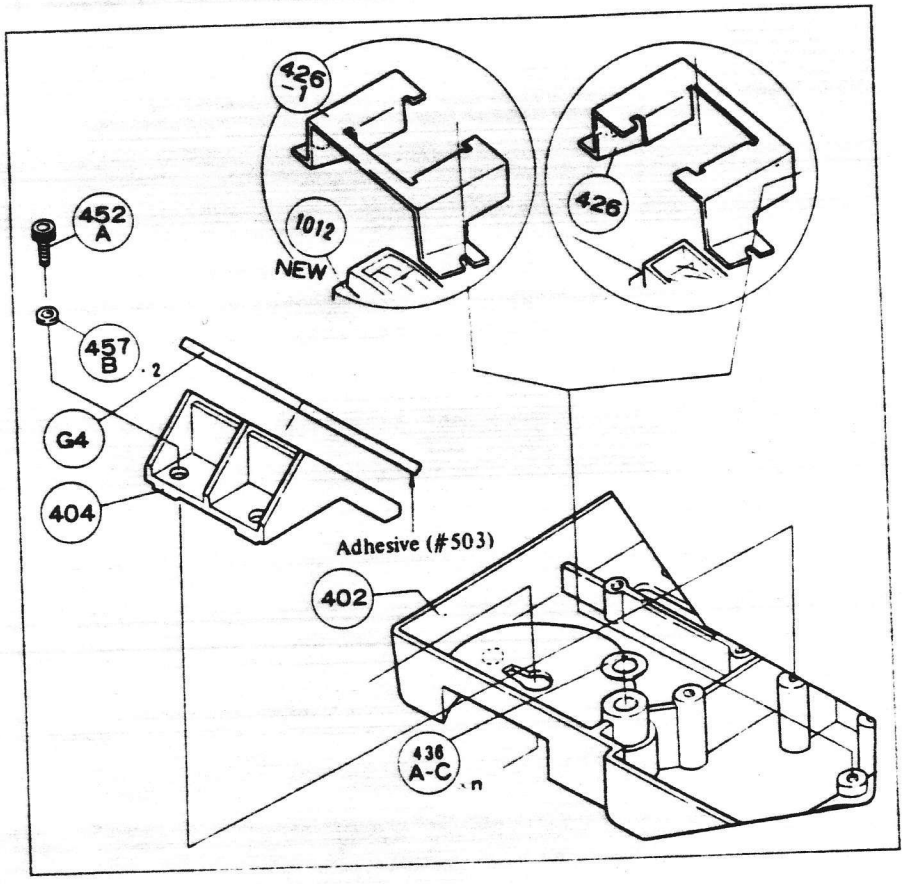

Fig. 35

11) Other parts can be disassembled in any sequence.

Note: Washers ((436A) ~ (436C))×n, used for adjusting slack, when attaching the base to the main body, should be returned to their original positions.

REASSEMBLY PROCEDURE

1. Coaxial Coarse and Fine Focus Knob Unit

1) Beforehand, clean (107), (109), (110), (123) ~ (128), (130), (131) using triclane.

2) Applying No. 616 to the thread of pinion shaft (109), screw it into spur gear (123).

3) Apply G7920 to (109) at the position indicated in Fig. 16, and insert the subassembly consisting of (109) and (123) into pinion case (105). Furthermore, attach pinion thrust receptacle (116) to (109). In this case, make sure of smooth rotation of (105) and (109).

4) Clean the thread of pinion case (105), using gasoline.
After drying, apply No. 350, and screw in coarse focus bearing (106). (Fig. 36).

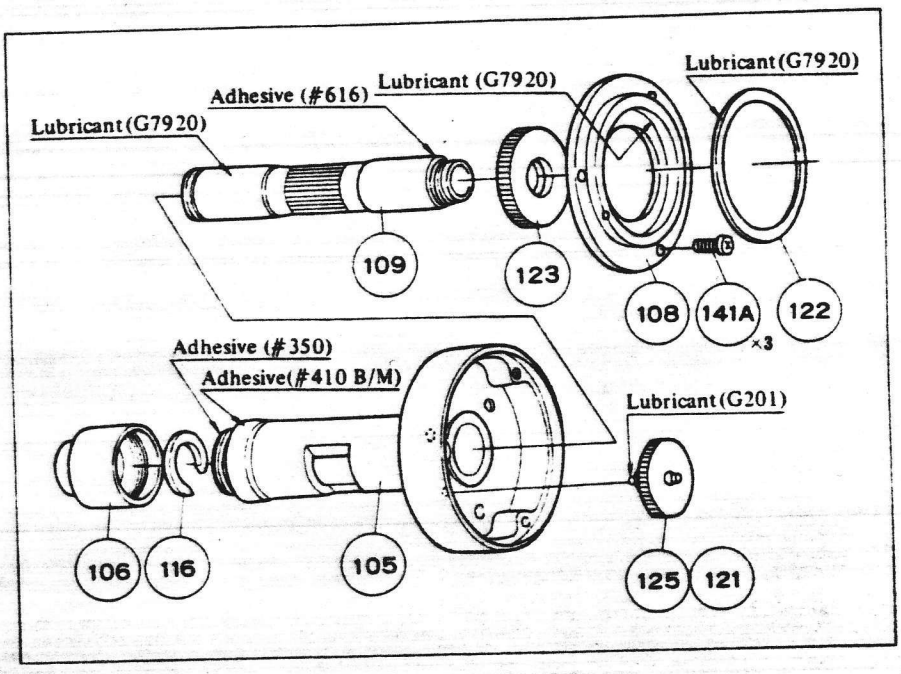

Fig. 36

5) Insert the above subassembly into the arm. (Fig. 37).

6) Inserting rack (9) from underneath the arm, attach it to the ball race by means of PM screw (41C) and CM screw (42A). (Fig. 38). After attaching, fix pinion case (105) to the arm by means of screws (41A) ×3. (Fig. 37).

Note: (106) might be scratched or deformed by the use of a wrench, when detached, in this case, replace it.

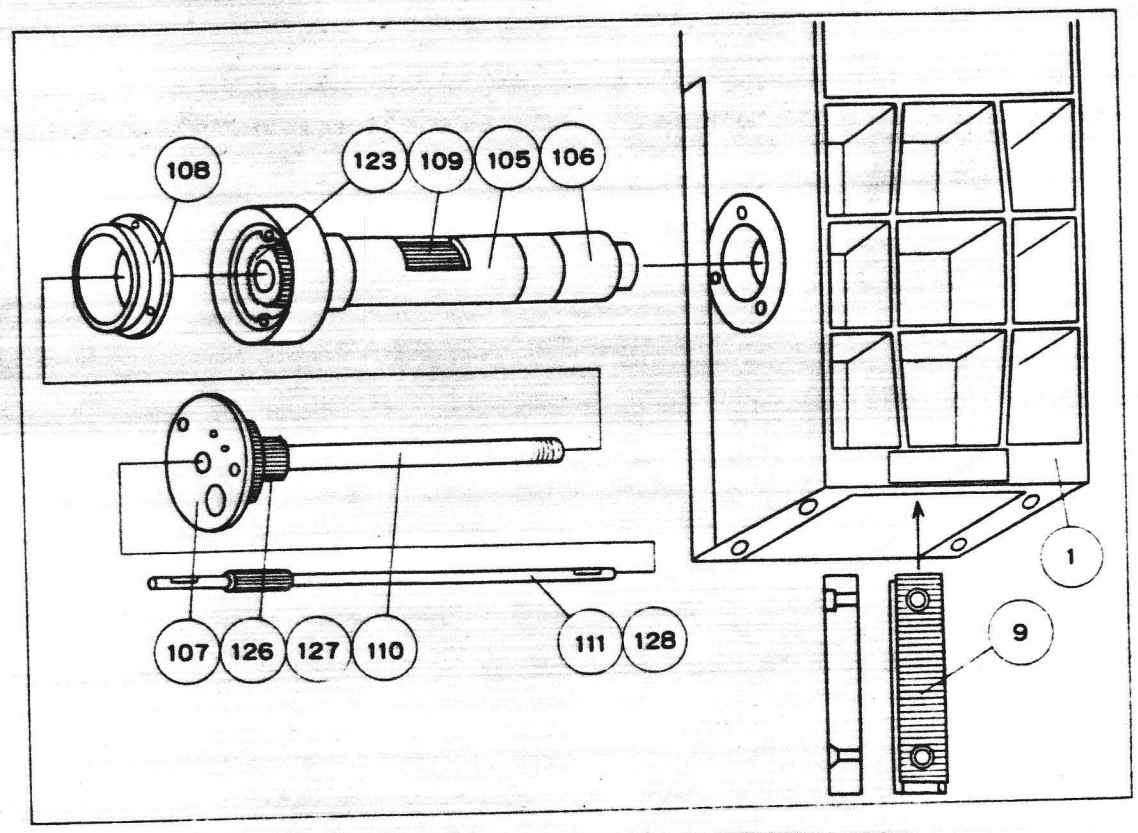

Fig. 37

7) Attach gears (121) and (125) to pinion case (105), and coarse focus knob bearing (108) (this should be cleaned, beforehand) to (105) by means of screws (141) ×3. ((121) and (125) are to be oiled as shown in Fig. 36, after cleaned and dried.)

8) Insert the subassembly consisting of (107) (coarse focus case) and (110) (coarse focus shaft) and (126) and (127) (gears), as shown in Fig. 37 (apply oil to (110) as shown in Fig. 10).

9) Thereafter, following 4)~ 1), reverse the disassembly procedure. (After cleaned and dried, fine focus shaft (111), gears (124) and (125), (130), (131) and (130A) and gears (124) and (125) should be oiled as shown in Fig. 24. OPTIPHOT

Cover plate (117) is to be cemented by No. 616. Apply G7920 to plate spring (118) and washer (120).

2. Substage Unit

For reassembly, reverse the disassembly procedure, taking the cautions as below:

1) The positions to be oiled or cemented should be cleaned and dried, beforehand. Use only the specified lubricant and adhesive.

2) Rotation torque of the condenser focus knob (210) is to be adjusted to 450g ~ 500g, when the knob is turned with pinion (208) held by the hand. Make the adjustment by turning the pinion bearing (212).
(Measuring procedure: Fig. 38)
After adjustment, fix the knob with set screw (236).

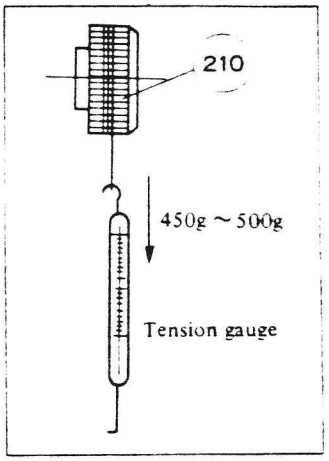

Fig. 38

3) If in Disassembly Process (5) (P. 24) both the dovetails have been removed simultaneously for an unavoidable reason, it will be necessary for finding the fiducial position to use the specified positioning tool.

4) Check for smooth movement of the sliding parts of the dovetails, without slack, unevenness or the like.

5) Proceed to fitting of the rack as below:
   i) Insert set screws (236) ×2 into the main body of substage.
   ii) Attach the knob to (201) with (236) ×2, transitorily.
   iii) Attach rack (207) to dovetail (male) (205) with (274) ×2.
   iv) After releasing (236) ×2 and inserting the dovetail, turn pinion bearing (212), so that the gearing of rack (207) is achieved, and fix it in this position with (236A) ×2 (utilizing the eccentricity of (212)).
   v) Make sure of no clearance between (201) and (212) and smooth operation without slack, unevenness or the like.

6) To attach the condenser mount follow the procedure as below (Fig. 27):

i) Attach spring retainer (214) to condenser receptacle (204) with screws (231A) ×2.

ii) Insert plate spring (213) between (204) and (214). Bend the spring as shown by the arrow in Fig. 39.

iii) Apply G7910 to the sliding surface of condenser centering mount (203), and condenser receptacle (204).

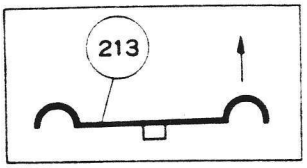

Fig. 39

iv) Insert (204) into (203).

v) Screw condenser clamp screw (215) into (204) through the opening of (203).

vi) See that no seizure occurs between (203) and (215), when manipulating right and left condenser centering screws (216) to bring (204) to the center, and (215) operates smoothly.

3. Arm Unit (OPTIPHOT, LABOPHOT)

For reassembly, reverse the disassembly procedure, taking the cautions as below:

1) Clean and dry the parts to be oiled or cemented as shown in Fig. 29, 30, and then apply the specified lubricant and adhesive.

2) If in Disassembly Procedure 7 (P. 22) the lefthand race (8) on the fiducial side has been dismounted for an unavoidable reason, use the right one as fiducial (Assuming that both the right and left races have not been dismounted).

3) Proceed to adjustment of the roller races as below:
   i) Fix (104) ×4 to the guide rails (10A) attaching surfaces of (8), using lubricant G202. (Fig. 40).
   ii) Attach (10B) ×4 to both the guide rail (10B) attaching surfaces of roller race (male) (7), using lubricant G202. (Fig. 40).
   iii) Apply lubricant G202 to the sliding surfaces of (10A), (10B) and cylindrical rollers (11).
   iv) Place cylindrical rollers (11) and retainer (12) onto the surfaces of (10A). At this time, insert (11) one after another in turn. (Fig. 29).
   v) Assemble (7) and (8), transitorily.
   vi) As shown in Fig. 21, pushing (8), adjust the torque of (7) to 100g ~ 120g. Fix it in this position with (43A) ×3.
   vii) Set it with (44A) ×6, and inject cementing agent No. 350 into (44A) at six points.

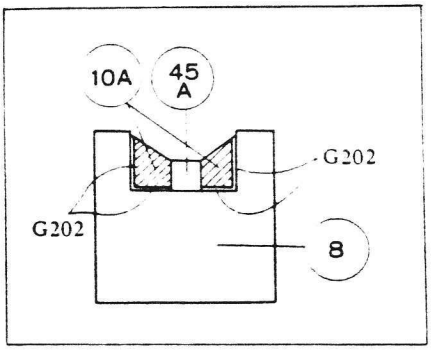

Fig. 40

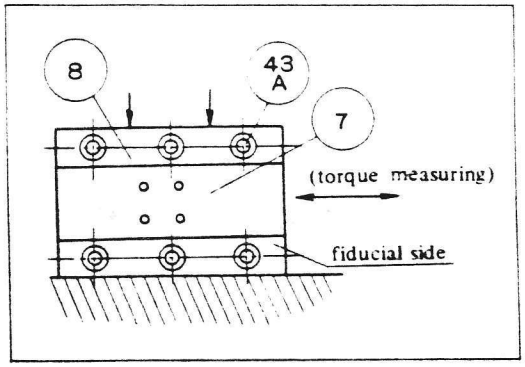

Fig. 41

4. Base Unit

For reassembly, reverse the disassembly procedure, remembering that the parts to be oiled or cemented (Fig. 32 ~ 35) are to be cleaned and dried, beforehand, and the specified lubricant or adhesive should be applied.

ADJUSTMENT

1. Torque of Coarse Focus Knob

1) Referring to Reassembly Procedure (P. 32), insert wave washer (119) and adjusting washer (121) in sequence, as shown in Fig. 42, into coarse focus shaft (110). After screwing coarse focus knob (104) and bush (115) into (110), make adjustment of the torque to 400g ~ 500g, by means of washers (121A), (121G).

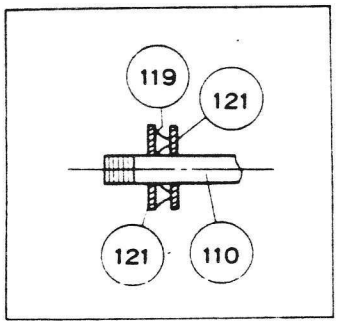

Fig. 42

2) When a correct torque is obtained, disassemble coarse focus knob (104) and bush (115).
Applying adhesive No. 410 to the thread, fix (104) and (115) in position. Be careful not to let the adhesive enter the internal surface of (110).

2. Smooth Turning of the Left Fine Focus Knob

1) Referring to Reassembly Procedure (P. 32), attach G7920 onto both sides of washer (120), and insert the washer into fine focus shaft (111). Then, insert left fine focus knob (102) into (111) (beforehand, place set screw (42A) into (102)), and set it with (142A) in such a position that the thrust slack of the knob is not felt by touching with the finger.

2) Make sure of seizure between coarse focus knobs (104) and (102), and their smooth turning.

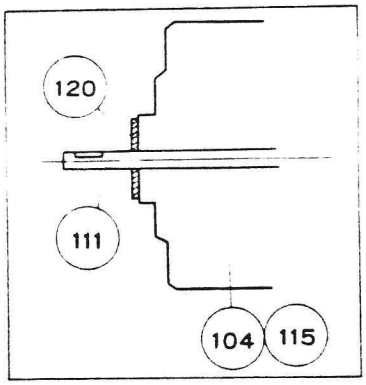

Fig. 43

3. Smooth Turning of the Right Fine Focus Knob

1) Referring to Reassembly Procedure (P. 32), insert right fine focus knob (101) into fine focus shaft (111) (beforehand, place set screw (142A) into (101)). Pushing the left and right fine focus knobs inwards, fix them in such positions by means of (142A), that a torque of 30g ~ 40g is obtained. (Measuring procedure: Fig. 38).

2) Make sure of no thrust slack felt by touching with the finger and no seizure between (101) and right coarse focus knob (103). Also, check for smooth turning of the fine and coarse focus knobs.

4. Parallelism between the Tube Attaching and Stage Attaching Surfaces

For checking the parallelism, the top surface of tube receptacle (3) serves as fiducial.

1) Bringing the tool collimator onto the top surface of tube receptacle (3), check the parallelism using a mirror placed on the surfaces (1), (2) and (3) one after another, as shown in Fig. 44.

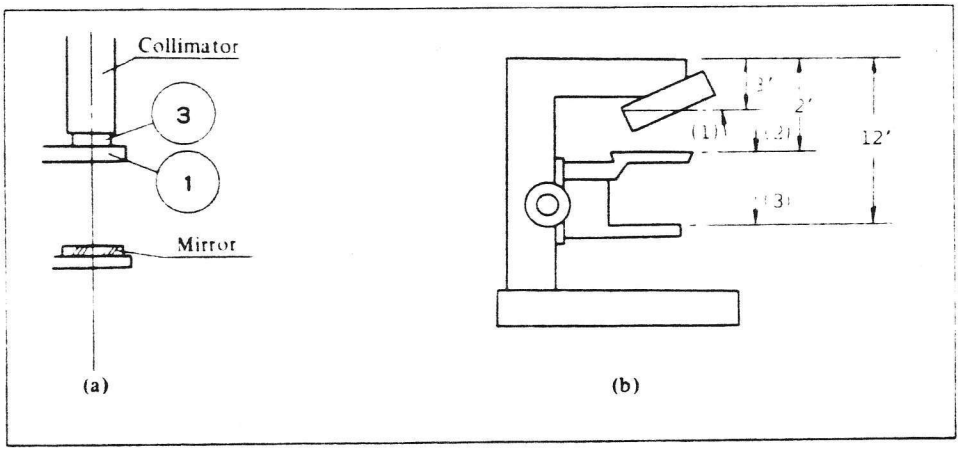

Fig. 44

2) The parallelism should be within the range as indicated in Fig. 44(b).

3) If this range is overrun, make the parallelism adjustment as follows:
Viewing toward the front of the microscope, release screws (43A) ×4 (first, two of them, and if not sufficient, all the four), and swing the whole substage laterally for X-direction. Then for Y-direction, using adjusting washers (15A) ~ (15C) between (7) and (201), swing back and forth, until the parallelism comes within the 5 specified range.

8. Adjustment of Brightness Control Circuit (Fig. 51, 52)

1) Turn off the power switch S_1 ((1004)).

2) Fully turn ( ) the shaft of variable resistor VR_3 in the DC ammeter M_1 ((1002)), counterclockwise.

3) Fully turn ( ) the shaft of variable resistor VR_1 ((1101)) in the printed circuit counterclockwise.

4) Change over the power change-over switch S_2 ((1005)) to AC 100V.

5) Set the power voltage to AC 100V ± 1%, 5 Hz.

6) Connect the thermostat-type voltmeter (over 1.5 class) for measuring the lamp voltage to the terminal of the lamp.

7) Plug the power source cord into the socket.
After connecting the halogen lamp of 12V, 50W with the lamp socket.

8) Turn on the power switch S_1 ((1004)).
Do not turn the power switch dial beyond the position where the switch is just turned ON (at a maximum voltage of variable resistor VR_2 ((1004)).
In this position the brightest illumination will be obtained.

9) Slowly turn the shaft of variable resistor VR_1 ((1101)) in the printed circuit, clockwise, and then the illumination of the lamp will be slowly darkened.
Stop this turning at the position where the lamp filament looks dim.
Do not turn the shaft beyond this limit, because the lamp will glow suddenly.

10) Turn the dial of power switch S_1 ((1004)) in the direction in which the voltage of variable resistor VR_2 ((1004)) becomes lower, until the thermostat-type voltmeter indicates 9.0V.

11) Turn the shaft of variable resistor VR_3 ((1010)) for sensitivity adjustment, clockwise, so that the DC ammeter M_1 ((1012)) indicates 9.0V.

12) Turn the dial of power switch S_1 ((1004)) to make the indication of DC ammeter M_1 ((1012)) minimum.
In this case, the voltage of variable resistor VR_2 ((1004)) will be maximum.

13) If the DC ammeter M_1 ((1012)) indicates a value not higher than 1.8, turn the shaft of variable resistor VR ((1101)) in the printed circuit, counterclockwise, and if it indicates a higher value than 2.5, slowly turn the shaft clockwise, until the meter indicates a value within the range 1.8 ~ 2.5V.

14) Fully turn the dial of power switch S_1 ((1004)) to make sure that the brightness of the lamp and swing of the needle in the DC ammeter M_1 ((1012)) changes smoothly over 11.5.